Abstract:

The objective of this research is to discuss whether motion capture devices and SVM(Support Vector Machine) instead of doctors can be effective for diagnosing shoulder pain. In this research, I only discuss shoulder pain caused by muscle injury while excluding skeletal and other diseases. In previous studies, many advanced devices have been used in rehabilitation therapy. In contrast, the use of motion capture devices and machine learning methods for medical diagnosis is still very rare. Diagnosis is more difficult than treatment because diagnosis requires greater accuracy. So the accuracy of diagnosis is paramount to our research. In this way, how to obtain accurate trajectory data and how to correctly process data become the problems of this research. We hope to solve the problem of labour shortage through high-tech.

In this research, I used Kinect2 to collect both healthy and unhealthy shoulder movements. Kinect 2 is a commonly used optical motion-capture device used in many medical research studies. A large number of these researches focus on rehabilitation treatment and evaluation of therapeutic effects. In this study, Kinect 2 is used to determine whether the moving ability of patient is up or not. I added a time control system to make up for these deficiencies. My Aim was to collect the research time together when the subjects take activity tests. I collected the real-time movement data of 13 feature points of each subject when they are asked to complete activity test actions. These activity test actions include:flexion, extension, horizontal extension and adduction, vertical extension and adduction, shoulder internal and external rotation action. The real-time data are described as three-dimensional space trajectories. The three-dimensional trajectory is merged into the data matrix of the motion trajectory through the operation of the program.

The goal of this research is to use a computer to complete preliminary, comprehensive and repetitive medical diagnoses In order to Significantly reduce a doctor's workload. Compared to manual labour, the machine cannot judge the shoulder condition of the subject by “touch diagnosis”. In order to make up for this deficiency, based on previous studies, I chose to use acceleration to improve the accuracy of this study. Acceleration also became a key piece of data in my research. After the preparatory experiment was completed, I proved acceleration is important information for distinguishing different conditions of shoulder pain. The results of acceleration are as follows: the peak acceleration of healthy people

is high and the change of acceleration is obvious, while the peak acceleration of patients is low and the change of acceleration is small. At the same time, I found the acceleration in this research, that came from real-time action data. Then, I decided to use sliding window method to process the real-time action data I collected to directly analyze the shoulder muscles. The sliding window method is a common partition method in time series analysis. At present, the convolution layer is not needed due to the small data sample. Each data of shoulder trajectory I collected use sliding window method to divide into 500 intervals, which is equivalent to 500 small movements. The average value of 500 specific motion data in each partition was calculated by sliding window method. The accuracy and robustness of trajectory detection data are guaranteed by sliding window.

Due to the small sample size, the processed data cannot be accurately classified in SVM. In order to improve the accuracy of the classifier. I used Random Forest and Oversampling method to improve the accuracy of the classifier. Then, I used the testing set to test the accuracy of the classifier. The results were the same as the physical diagnosis.

This study mainly looks at the possibility of motion capture devices and SVM systems being used for medical diagnosis. After solving the problems of this research, the correct diagnosis results could be obtained. That's exactly what I had in mind. However, due to the small sample size, the diagnosis is not very accurate. This can be solved by expanding the sample size. I will solve this problem in future research. The results of this research can be used to prove that the system composed of Kinect 2 and SVM can be used to diagnose shoulder muscle injury. Thus, this system can be used for completing preliminary, massive and repetitive work to reduce doctors' workload greatly. This is a very useful attempt.

The objective of this research is to discuss whether motion capture device and SVM(Support Vector Machines) instead of doctors can be effective to reduce time for diagnosing shoulder pain. The system consists of Kinect 2 and SVM. Kinect 2 as a research device is used to collect data of subjects' motion trajectory, and the data input SVM for classification. Before that, I had finished the work of SVM classifier. This classifier can effectively determine the difference between healthy people and patients when they complete the active tests. The accurate diagnostic result is given after data analysis.